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PRE-MOLDED TYPE SEMICONDUCTOR DEVICE

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[There are no amendments to this patent.]

Claims

1. A pre-molded type semiconductor device characterized by the fact that steps are formed on the side surfaces of a lead frame on which a semiconductor pellet is mounted, and the lower brim portions of said steps are buried in a resin mold portion.

2. The pre-molded type semiconductor device described in Claim 1 characterized by the fact that collar-shaped steps are formed on the side surfaces of a die pad portion on which the semiconductor pellet is mounted.

3. The pre-molded type semiconductor device described in Claim 1 characterized by the fact that collar-shaped steps are formed on the side surfaces of a die pad portion formed by extending the die pad portion.

4. The pre-molded type semiconductor device described in Claim 1 characterized by the fact that collar-shaped steps are formed on the side surface portions of the inner leads.

Detailed explanation of the invention

Industrial application field

This invention pertains to a pre-molded type semiconductor device using a lead frame.

Prior art

Figure 2 is an oblique view of a hollow type ceramic package.

At present, hollow type ceramic packages are mainly used for EPROMs (Erasable Programmable ROMs) and other memory elements, CCDs, MOS transistors, and other solid state image pickup elements, and other elements with a photoelectric conversion function. Figure 2 is a diagram illustrating the structure of such a package. In this figure, (5) represents a semiconductor pellet; (6) represents lead wires; (7') represents inner terminals; (8') represents a light receiving window frame; (12) represents external electrode lead-out portions; (13) represents a ceramic package; (14) represents a metallized portion; (15) represents a ceramic substrate; and (16) represents outer terminals.

Assembly of the hollow type ceramic package shown in Figure 2 is performed as follows. First of all, on metallized portion (14) on ceramic substrate (15), an epoxy resin, silver paste, or another electroconductive resin is used to die bond semiconductor pellet (5). Then, using gold, aluminum or other metal wires, inner terminals (7') and outer electrode lead-out portions (12) are wire bonded. Then, after formation of lead wires (6), a light transmissive material is used to form light receiving window frame (8') set on the upper surface portion of semiconductor pellet (5).

For said hollow shaped ceramic package, because of gas-tight sealing, resin cracks, etc. are not formed. Consequently, the reliability is high, while the price is high. As a result, this type of package is not appropriate for mass production of equipment for public use at a low cost. As a

scheme opposite the hollow shaped ceramic package, plastic material is used for the package and a lead frame is adopted for the members so as to significantly lower the cost.

Figure 3 is a front view illustrating the structure as one looks inward from the light receiving unit shown in Figure 2. Figure 4 shows diagrams illustrating the structure of a conventional pre-molded type plastic package. Figure 3(b) [sic; 4(b)] is a cross-sectional view taken across g-g' in Figure 4(a). In the figures, (7) represents the lead frame inner terminals (inner leads); (8) represents a light receiving window; (9) represents a plastic package; (10) represents a lead frame die pad portion; (11) represents a resin mold portion; and (16) represents lead frame outer terminals.

The process for preparing the pre-molded type plastic package shown in Figures 3 and 4 is performed as follows. First of all, resin mold portion (11) is used to perform pre-molding up to the height of the side surfaces of the lead frame. Then, a semiconductor pellet is mounted on die pad portion (10) made of a 42% Ni-Fe alloy or copper based alloy by means of a Au-Si eutectic [alloy] or Pb-Sn based solder, or an epoxy based paste or the like. Then, wire bonding is performed between the outer electrode lead-out portions of the semiconductor pellet and lead frame inner terminals (7) with lead wires. Then, light transmissive window (8) is gas-tight sealed with an adhesive or the like.

Problems to be solved by the invention

In conventional EPROM, solid-state image pickup element, or another pre-molded type plastic packaging technology, after lead frame inner terminals (7) and lead frame die pad portion (10) are molded with a resin, the semiconductor pellet is die bonded, and then wire bonding is performed between outer electrode lead-out portions of the semiconductor pellet and lead frame inner terminals (7). Consequently, it is impossible to cover the surfaces of lead frame inner terminals (7) and lead frame die pad portion (10) with the resin. As a result, as shown in Figure 4(b), contact between lead frame inner terminals (7) as well as lead frame die pad portion (10) and resin mold portion (11) can be maintained only on the side surface and inner surface portions. Consequently, in the case of a thermal impact, such as rapid heating or rapid cooling, due to differences in the thermal expansion coefficient of lead frame inner terminals (7) as well as lead frame die pad portion (10) and resin mold portion (11), a contractive stress is generated in resin mold portion (11), and cracks may readily form along stress branching lines. In such a case, stress acts on portions in close contact with resin mold portion (11), lead frame die pad portion (10), the tie bar portion (die pad support portion) formed as an extension of the die pad portion, lead frame inner terminals (7) etc. Consequently, damage to the close contact may readily occur, and, as shown in Figure 4(c), various defects take place for the pre-molded type semiconductor device. This is undesirable.

The objective of this invention is to solve the aforementioned problems of conventional methods by providing a type of pre-molded type semiconductor device characterized by the fact that by improving the close contact state of the die pad and leads, etc. of the lead frame where the semiconductor pellet is set and of the resin mold portion, various problems can be prevented and high reliability can be realized.

Means to solve the problems

For this objective, this invention provides a pre-molded type semiconductor device characterized by the fact that collars are formed on the side surfaces of the die pad portion for mounting a semiconductor pellet, the tie bar portion formed as an extension of the die pad portion, as well as leads, etc., and the collars are buried in a resin mold portion. Also, the pre-molded type semiconductor device of this invention is characterized by the fact that the EPROM or another memory element, or sold-state image pickup element, or another semiconductor pellet is an element having a light receiving portion.

Operation

According to this invention, collars are formed on the side surfaces of the die pad portion for mounting a semiconductor pellet, the tie bar portion formed as an extension of the die pad portion, as well as leads, etc., and the collars are buried in a resin mold portion. Consequently, contact between the various lead frame portions and the resin mold portion is strong. As a result, the close contact state between the two cannot be broken easily, and a stable pre-molded type semiconductor device can be obtained.

Application examples

In the following, this invention will be explained in more detail with reference to application examples illustrated by figures.

Figure 1 illustrates an example of the constitution of a pre-molded type plastic package in an application example of the pre-molded type semiconductor device of this invention. (a) is a front view through a light transmissive window frame. (b) and (c) are cross section taken across d-d'. In the figures, (7) represents lead frame inner terminals (inner leads); (10) represents a lead frame die pad portion; and (11) represents a mold resin portion.

As shown in Figure 1, for lead frame inner terminals (7) and lead frame die pad portion (10), on their side surfaces, collar-shaped steps buried in resin mold portion (11) are formed as indicated by the broken lines in (a) and the cross section in (b) and (c). In this pre-molded type semiconductor device, lead frame die pad portion (10) and lead frame inner terminals (7) are formed by punching Kovar or another thin sheet. Figures 1(b) and (c) are schematic cross section

taken across d-d' as shown in Figure 1(a). The cross-sectional shape shown in Figure 1(b) is shown as a schematic sketch. When chemical etching is performed on both sides, the cross-sectional shape becomes that shown in Figure 1(c).

Also, this invention is not limited to the aforementioned application examples. Various modifications can be made. In the aforementioned application examples, only two cross-sectional shapes of the collar portions are shown. However, any shape that can be buried in the mold resin may be adopted. Also, for example, the collar portions may be formed in an intermittent shape. Although not shown in the figure, in addition to the lead frame die pad portion and lead frame inner terminal portion, the collar portions may also be set on the tie bar portion.

Effect of the invention

As explained above, according to this invention, collars are formed on the side surfaces of the die pad portion for mounting a semiconductor pellet, the tie bar portion formed as an extension of the die pad portion, as well as leads, etc., and collars are buried in a resin mold portion. Consequently, after packaging, if, for example, a heat impact is applied, and a shrinking stress or the like is generated due to differences in the contraction coefficient between the lead frame and the resin mold portion, it is possible to prevent mismatch of the various portions of the lead frame by means of the collars.

Consequently, it is possible to obtain the same reliability as that of a conventional hollow shaped ceramic package. Also, the price is lower. Consequently, mass production of packages for use in solid-state image pickup elements used in public equipment is possible.

<u>Brief description of the figures</u>

Figure 1 illustrates an example of the constitution of a pre-molded type plastic package in Application Example 1 of the pre-molded type semiconductor device in this invention. Figure 1(a) is a front view of the portion within the light transmissive window frame. Figures 1(b) and (c) are cross section taken across d-d'. Figure 2 is an oblique view of a hollow shaped ceramic package. Figure 3 is a front view of the interior as seen from the light receiving window of Figure 2. Figure 4 shows diagrams illustrating the structure of a conventional pre-molded type plastic package. Figure 3[sic; 4] (b) is a cross-sectional view taken across g-g' in (a).

7 Lead frame inner terminal (inner leads)
10 Lead frame die pad portion
11 Mold resin portion

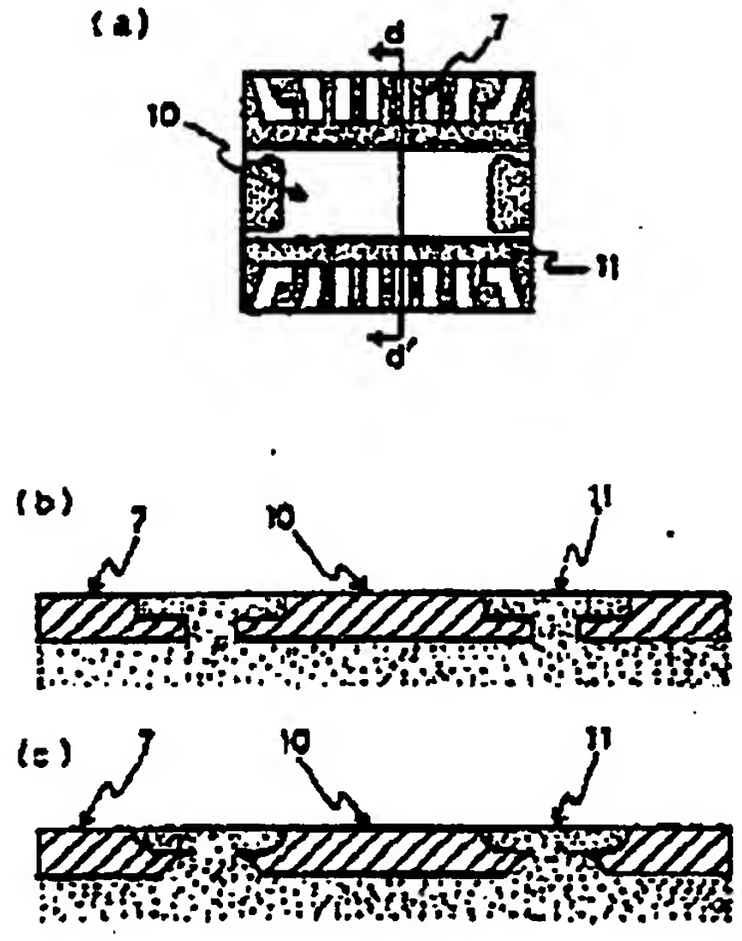

Figure 1

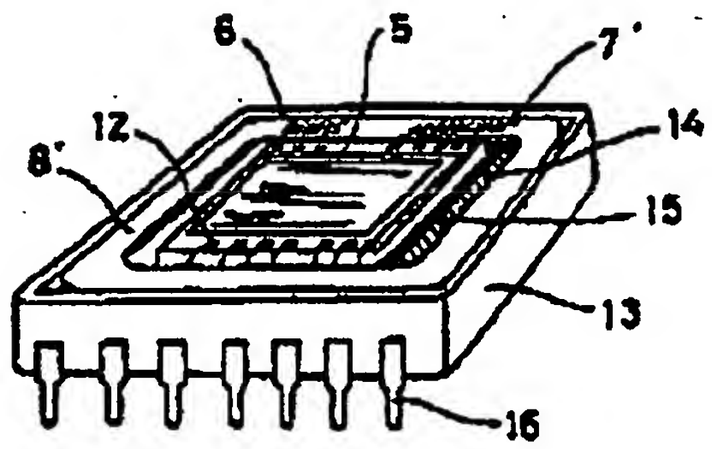

Figure 2

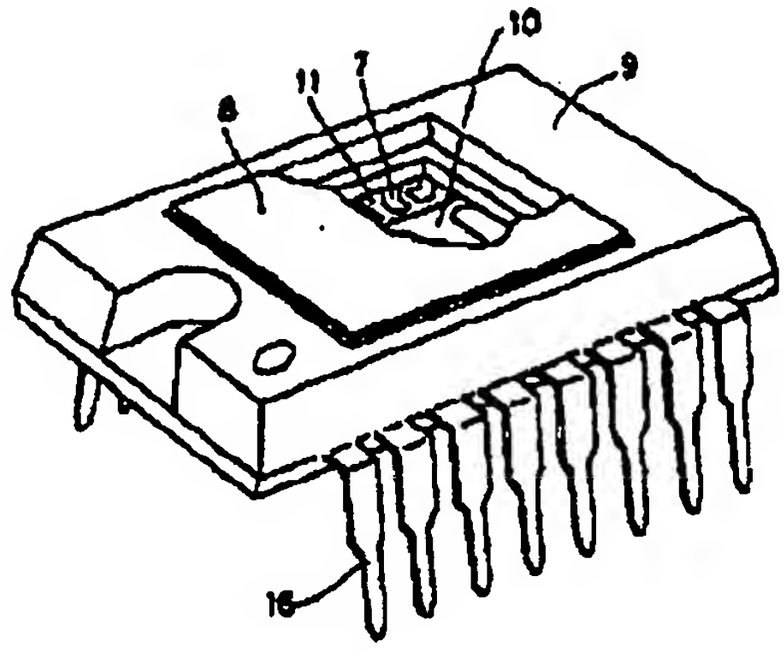

Figure 3

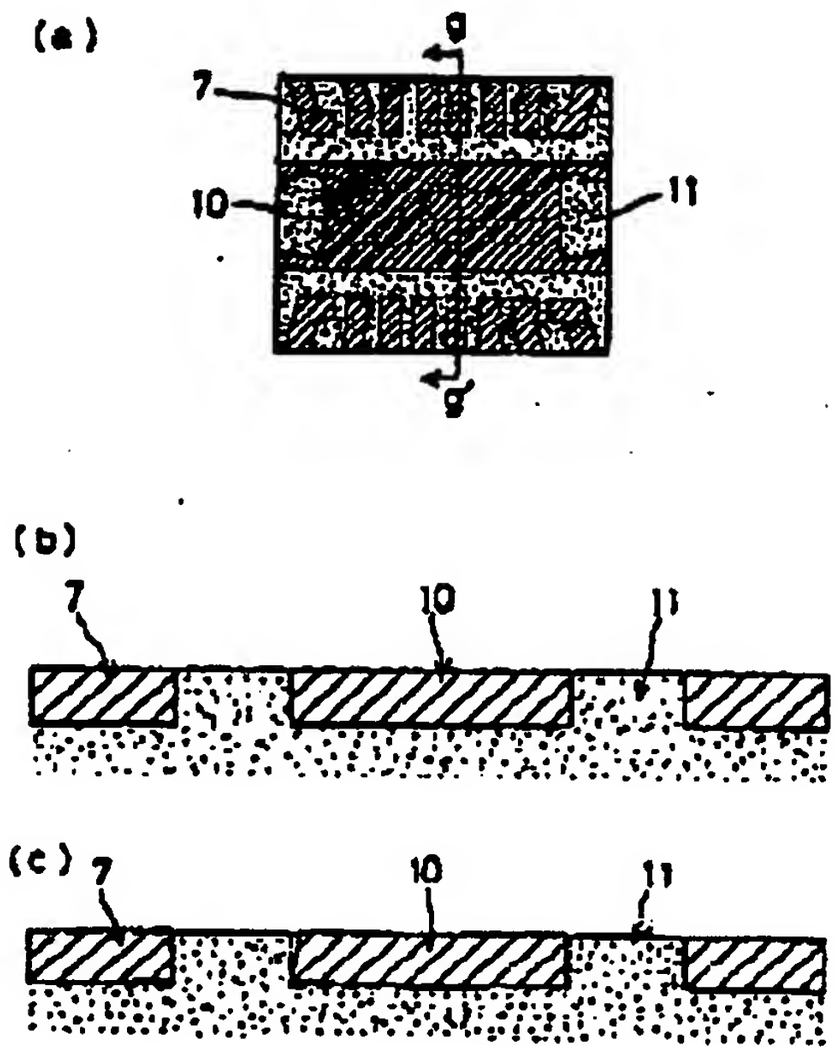

Figure 4